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Some geologists think that about this time the upper part of the St. Lawrence basin, including all the lakes, excepting Ontario, discharged its waters northward from Lake Superior. But even without this doubtful part the drainage area of this one great northern river would be seven times that of the present St. Lawrence. Judging from the ancient erosion of the valleys and from other considerations, the annual precipitation was at least as great then as now, so that this former river must have been of gigantic proportions compared with any river of the present world.

Its catch-basin would extend from the sources of the Saskatchewan and the Athabasca beyond the Rocky mountains to near the eastern coast of Labrador, and from the Minnesota river in the south to the northern part of Baffin Land and would also include the southern part of the great McKenzie basin. It would flow through the center of Hudson Bay and down Hudson Strait. The former existence of this great river was not a mere speculation as to what might have been, but a necessary consequence of the elevation and change in the slope of the land, and it was proved in detail by a multitude of concordant facts all over the territory involved.

Missouri Geological Survey. Vols. IV. and V., Palæontology of Missouri, by CHARLES ROLLIN KEYES, A.M., Ph.D., State Geologist, pp. 271 and 266. Vols. VI. and VII., Lead and Zinc Deposits, by ARTHUR WINSLOW, assisted by JAMES D. ROBERTSON, pp. xxi. + 763. Jefferson City, 1894.

The issuance in rapid succession of four volumes of the reports of the Missouri Survey indicates a laudable administrative activity. They bring us a grateful relief from the solicitude that was recently felt for the future of the survey. While much of the work of which these four volumes are an expression was done under the previous administration of Mr. Winslow and is to be credited to him and his colaborers, much credit is also due to the administration of Mr. Keyes for their present creditable issuance, as well as for his own large contribution to them.

Volumes IV. and V. relate to palæontology and were prepared by Director Keyes. Volume IV. opens with an introductory chapter on the nature and importance of palæontological data. This is followed by a synoptical description of the formations of Missouri, and a chapter on the biological relations of fossils, these three chapters being preliminary to the descriptions of fossils which make up the remaining six chapters of the volume and the six chapters of the succeeding volume.

The grouping of the descriptions of fossils is biological, the chapters embracing Protozoans and Sponges (IV.), Hydrozoids and Corals (V.), Echinoids and Asterids (VI.), Cystids and Blastoids (VII.), Crinoids (VIII.), Worms and Crustaceans (IX.). These are in the main re-descriptions of species already known, the justification of this appearing in the author's introduction, in which the inaccessibility of the larger part of the original descriptions and the imperfection of some of them is urged. Twenty-one lithographic plates are given to illustrate the fossils described. An appendix containing a stratigraphic catalogue of Missouri fossils and a geological map of the state are added.

Volume V. is practically a continuation of Volume IV. and embraces six chapters relating to polyzoans, brachiopods, lamellibranchs, gasteropods, cephalopods and vertebrates. These are followed by an indexed list of the fossils of Missouri. Twenty-four illustrative plates accompany this volume.

Volumes VI. and VII. relate to the lead and zinc deposits, and are the work of ex-Director Winslow. As in the palæontological part, the separation into two volumes is merely a matter of mechanical convenience, the contents being closely consecutive. The subject is opened with a historical sketch of lead and zinc mining. The treatment is brief, but covers a wide range in time and geographic distribution. The nature of the metals is then discussed, followed by a chapter devoted to their distribution. Emphasis is laid upon the distinction between the diffused and the concentrated conditions, a distinction which is wholly determinative of their economic value, and scarcely less important in the study of their genesis. The ore deposits are classified successively on the basis of their composition, the mode of formation of the constituents, their sources, the forms of the ore body, the attitudes of the ore body, their structures, the natures of the associated substances, the natures of the calcareous rocks, and their geological position. A synoptical description of the lead and zinc deposits of foreign countries and of states other than Missouri occupies two chapters, and gives evidence of good judgment in the selection of the more important data. This is followed by a chapter prepared by James D. Robertson on the metallurgy of the metals, illustrated with cuts of furnaces and other appliances, and accompanied by statistics of production.

The foregoing constitutes Part I. and is preliminary to the special discussion of the Missouri ores and the industry built upon them, which forms Part II. This embraces the history of mining in Missouri, discussions of the physiography of the mining districts and their general geology; a description of the ore deposits, under the heads of distribution, forms, composition, gangues, mineral types, structure and mode of formation, and further statistics regarding the lead and zinc industry.

Part III. is devoted to a detailed description of the mines in which the local occurrence of the ores is set forth with much fullness (200 pages of fine print, admirably illustrated by sections, sketches, maps and photographs).

To the geologist the chief interest of Mr. Winslow's important report doubtless centers in his discussion of the origin of the ores. He points out the grave objections to those hypotheses which postulate the derivation of the ores from solutions rising from great depths. His own opinion coincides in its main features with those of Whitney and Chamberlin respecting the analogous deposits of Wisconsin and adjacent states. He assigns the remote origin of the metalliferous material to the Archæan rocks, whence they were derived by surface decomposition. This material he believes was redeposited by the oceanic waters in the Palæozoic sediments whence it was rederived by surface decomposition and concentrated in the cavities where it is now found. He believes the diffusion of the metalliferous compounds in the Palæozoic sediments was general and rejects the view of Chamberlin that the localization of the deposits was partly due to local enrichment of the oceanic waters corresponding to local richness of the Archæan areas, partly to the courses the oceanic currents followed and partly to the topography of the sea bottom on which the metal-bearing sediments were laid down, aided by a differential distribution of the sea life which gave rise to the agencies of precipitation. He makes the concentration of the ores in the crevices purely secondary, the result of local conditions favorable to concentration. He appears in some slight degree to have misinterpreted Chamberlin's view in that he makes it inapplicable to rocks of different ages. To be sure the discussion of the Wisconsin deposits and the map of the currents were made specifically applicable to the Silurian deposits under immediate discussion, but the map recognizes that the ore deposits are of different ages and the context makes the hypothesis applicable to deposits of other ages. Of course changes in the courses of the currents, changes in the areas of derivation, and in those of deposition must be taken into consideration in explaining the later deposits. If the hypothesis urged by Chamberlin is good at all, it is applicable to all ages, because there must always have been different degrees of enrichment of the oceanic waters in different parts corresponding to the different amounts of metalliferous material brought in from the land and this must have been carried in the direction of prevailing currents. If the inequalities of the sea bottom tended to concentrate metalliferous deposits at one age they should do so at others under similar conditions. Mr. Winslow lays much emphasis upon the degradation of the formations whereby the disseminated metals were removed from their original matrix and brought together in the crevices or cavities in which the ores were accumulated. He justly points out the distinction between this and the narrow views of lateral secretion against which some authors have argued. Perhaps on his own part he is not wholly beyond criticism in the same direction in his interpretation of the views of Whitney and Chamberlin which are scarcely distinguishable from his own in this particular. The ideal diagram on page 548 of *The Ore Deposits of Southwestern Wisconsin*, Vol. IV., Geology of Wisconsin, very sharply emphasizes the function of surface decomposition, conjoined with concentration and segregation below. But this is rather a matter of nice toning and shading of opinion than of important distinctions. The report is much to be commended for its great array of facts which will form a memorable contribution to the science of ore deposits. Mr. Winslow has prepared a list of errata which he will gladly send to any desiring it.

T. C. C.

Elementary Palæontology for Geological Students. By HENRY WOODS, B.A., F.G.S. [Cambridge University Press. Macmillan & Co., N. Y.]

This book will supply a want felt in all colleges where historical geology or palæontology is taught. It is something that has been lacking in the English literature on this subject. Though we have great palæontologists and have in our libraries numerous large and well written works on palæontology in various foreign languages and